

CLAIMS

1. A method for manufacturing a micro-structural unit by performing machining on a material substrate which has a
5 laminated structure comprising a first conductive layer, a second conductive layer, a third conductive layer, a first insulating layer interposed between the first conductive layer and the second conductive layer, and a second insulating layer interposed between the second conductive
10 layer and the third conductive layer, the method comprising:

a first etching step for performing an etching treatment on the first conductive layer to an intermediate point in a direction of thickness of the first conductive
15 layer via a first mask pattern and a second mask pattern formed on the first conductive layer;

a step for removing the second mask pattern;

a second etching step for performing an etching treatment on the first conductive layer via the first mask
20 pattern until the first insulating layer is reached, so that residual mask parts that contact the first insulating layer are left;

a third etching step for performing an etching treatment via the residual mask parts on portions of the
25 first insulating layer that are exposed in the second etching step until the second conductive layer is reached;
and

a fourth etching step for removing the residual mask parts by etching, and for performing an etching treatment on portions of the second conductive layer that are exposed in the third etching step.

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2. The method according to claim 1, wherein in the fourth etching step, the etching treatment performed on the exposed portions of the second conductive layer is continued until the second insulating layer is reached.

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3. The method according to claim 1, further comprising a fifth etching step for performing an etching treatment on the third conductive layer via a third mask pattern formed on the third conductive layer, the etching treatment on the
15 third conductive layer being continued until the second insulating layer is reached.

4. The method according to claim 2, wherein: the first mask pattern comprises mask parts for a comb tooth-shaped
20 electrode;

first conductive parts of the comb tooth-shaped electrode are formed in the first conductive layer in the second etching step;

insulating parts of the comb tooth-shaped electrode
25 are formed in the first insulating layer in the third etching step; and

second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer in the fourth etching step.

5 5. The method according to claim 3, wherein:

the third mask pattern comprises first mask parts for a comb tooth-shaped electrode;

the second mask pattern comprises second mask parts for the comb tooth-shaped electrode;

10 first conductive parts of the comb tooth-shaped electrode are formed in the third conductive layer in the fifth etching step;

residual mask parts for the comb tooth-shaped electrode are formed in the first conductive layer in the
15 second etching step; and

second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer, and the residual mask parts are removed by etching, in the fourth etching step;

20 the method further comprising a sixth etching step for forming insulating parts of the comb tooth-shaped electrode in the second insulating layer, the insulating parts being interposed between the first conductive parts and the second conductive parts.

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6. The method according to claim 3, wherein:

the third mask pattern comprises first mask parts for a first comb tooth-shaped electrode;

the second mask pattern comprises second mask parts for the first comb tooth-shaped electrode;

the first mask pattern comprises mask parts for a second comb tooth-shaped electrode;

5 first conductive parts of the first comb tooth-shaped electrode are formed in the third conductive layer in the fifth etching step;

residual mask parts for the first comb tooth-shaped electrode and first conductive parts of the second comb tooth-shaped electrode are formed in the first conductive layer in the second etching step;

insulating parts of the second comb tooth-shaped electrode are formed in the first insulating layer in the third etching step; and

15 second conductive parts of the first comb tooth-shaped electrode and second conductive parts of the second comb tooth-shaped electrode are formed in the second conductive layer, and the residual mask parts for the first comb tooth-shaped electrode are removed by etching, in the fourth etching step;

the method further comprising a sixth etching step for forming insulating parts of the first comb tooth-shaped electrode in the second insulating layer, the insulating parts being interposed between the first and second conductive parts of the first comb tooth-shaped electrode.

7. A method for manufacturing a micro-structural unit by performing machining on a material substrate which has a

laminated structure comprising a first conductive layer, a second conductive layer, a third conductive layer, a first insulating layer interposed between the first conductive layer and the second conductive layer, and a second
5 insulating layer interposed between the second conductive layer and the third conductive layer, the method comprising:

a first etching step for performing an etching treatment on the first conductive layer via a first mask
10 pattern and a second mask pattern formed on the first conductive layer until the first insulating layer is reached;

a second etching step for performing an etching treatment on portions of the first insulating layer that
15 are exposed in the first etching step, the etching treatment being continued until the second conductive layer is reached:

a step for removing the second mask pattern; and

a third etching step for performing an etching
20 treatment on the first conductive layer via the first mask pattern, and for performing an etching treatment on portions of the second conductive layer that are exposed in the second etching step.

25 8. The method according to claim 7, wherein in the third etching step, the etching treatment performed on the first conductive layer is continued until the first insulating layer is reached, the etching treatment performed on the

exposed portions of the second conductive layer being continued until the second insulating layer is reached.

9. The method according to claim 7, further comprising a fourth etching step for performing an etching treatment on the third conductive layer via a third mask pattern formed on the third conductive layer, the etching treatment being continued until the second insulating layer is reached.

10. The method according to claim 8, wherein:

the first mask pattern comprises mask parts for a comb tooth-shaped electrode;

first conductive parts of the comb tooth-shaped electrode are formed in the first conductive layer in the first etching step;

insulating parts of the comb tooth-shaped electrode are formed in the first insulating layer in the second etching step; and

second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer in the third etching step.

11. The method according to claim 9, wherein:

the third mask pattern comprises first mask parts for a comb tooth-shaped electrode;

the second mask pattern comprises second mask parts for the comb tooth-shaped electrode;

first conductive parts of the comb tooth-shaped electrode are formed in the third conductive layer in the fourth etching step;

residual mask parts for the comb tooth-shaped electrode are formed in the first conductive layer in the first etching step; and

second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer, and the residual mask parts are removed by etching, in the third etching step;

the method further comprising a fifth etching step for forming insulating parts of the comb tooth-shaped electrode in the second insulating layer, the insulating parts being interposed between the first conductive parts and the second conductive parts.

12. The method according to claim 9, wherein:

the third mask pattern comprises first mask parts for a first comb tooth-shaped electrode;

the second mask pattern comprises second mask parts for the first comb tooth-shaped electrode;

the first mask pattern comprises mask parts for a second comb tooth-shaped electrode;

first conductive parts of the first comb tooth-shaped electrode are formed in the third conductive layer in the fourth etching step;

residual mask parts for the first comb tooth-shaped electrode and first conductive parts of the second comb

tooth-shaped electrode are formed in the first conductive layer in the first etching step;

insulating parts of the second comb tooth-shaped electrode are formed in the first insulating layer in the
5 second etching step; and

second conductive parts of the first comb tooth-shaped electrode and second conductive parts of the second comb tooth-shaped electrode are formed in the second conductive layer, and the residual mask parts are removed by etching,
10 in the third etching step;

the method further comprising a fifth etching step for forming insulating parts of the first comb tooth-shaped electrode in the second insulating layer, the insulating parts being interposed between the first and the second
15 conductive parts of the first comb tooth-shaped electrode.

13. The method according to claim 9, further comprising a fifth etching step and a sixth etching step, wherein the fifth etching step is provided for performing an etching
20 treatment on portions of the second insulating layer that are exposed in the fourth etching step, the etching treatment of the fifth etching step being continued until the second conductive layer is reached, the sixth etching step being provided for performing an etching treatment on
25 portions of the second conductive layer that are exposed in the fifth etching step, the etching treatment of the sixth etching step being continued until the first insulating layer is reached.

14. The method according to claim 13, wherein:

the third mask pattern comprises mask parts for a comb tooth-shaped electrode;

5 first conductive parts of the comb tooth-shaped electrode are formed in the third conductive layer in the fourth etching step;

insulating parts of the comb tooth-shaped electrode are formed in the second insulating layer in the fifth etching step; and

10 second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer in the sixth etching step.

15. The method according to claim 13, wherein:

15 the third mask pattern comprises first mask parts for a comb tooth-shaped electrode;

the first mask pattern comprises second mask parts for the comb tooth-shaped electrode;

20 first conductive parts of the comb tooth-shaped electrode are formed in the third conductive layer in the fourth etching step;

first insulating parts of the comb tooth-shaped electrode are formed in the second insulating layer in the fifth etching step;

25 second conductive parts of the comb tooth-shaped electrode are formed in the second conductive layer in the sixth etching step; and

third conductive parts of the comb tooth-shaped electrode are formed in the first conductive layer in the third etching step;

the method further comprising a seventh etching step
5 for forming second insulating parts of the comb tooth-shaped electrode in the first insulating layer, the second insulating parts being interposed between the second conductive parts and the third conductive parts.

10 16. The method according to claim 13, wherein:

the third mask pattern comprises mask parts for a first comb tooth-shaped electrode and first mask parts for a second comb tooth-shaped electrode;

the first mask pattern comprises second mask parts for
15 the second comb tooth-shaped electrode;

first conductive parts of the first comb tooth-shaped electrode and first conductive parts of the second comb tooth-shaped electrode are formed in the third conductive layer in the fourth etching step;

20 first insulating parts of the first comb tooth-shaped electrode and first insulation parts of the second comb tooth-shaped electrode are formed in the second insulating layer in the fifth etching step;

second conductive parts of the first comb tooth-shaped
25 electrode and second conductive parts of the second comb tooth-shaped electrode are formed in the second conductive layer in the sixth etching step; and

third conductive parts of the second comb tooth-shaped electrode are formed in the first conductive layer in the third etching step;

the method further comprising a seventh etching step
5 for forming second insulating parts of the second comb tooth-shaped electrode in the first insulating layer, the second insulating parts being interposed between the second and the third conductive parts of the second comb tooth-shaped electrode.

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17. The method according to claim 7, further comprising:

a fourth etching step for performing an etching treatment on the third conductive layer via a third mask pattern and a fourth mask pattern formed on the third
15 conductive layer until the second insulating layer is reached;

a fifth etching step for performing an etching treatment on portions of the second insulating layer that are exposed in the fourth etching step;

20 a step for removing the fourth mask pattern; and

a sixth etching step for performing an etching treatment on the third conductive layer via the third mask pattern until the second insulating layer is reached, and for performing an etching treatment on portions of the
25 second conductive layer that are exposed in the fifth etching step until the first insulating layer is reached.

18. The method according to claim 17, wherein:

the third mask pattern comprises mask parts for a first comb tooth-shaped electrode and a first mask parts for a second comb tooth-shaped electrode;

5 the second mask pattern comprises second mask parts for the second comb tooth-shaped electrode;

the first comb tooth-shaped electrode and first residual mask parts for the second comb tooth-shaped electrode are formed in the third conductive layer in the
10 fourth etching step;

residual mask parts for the first comb tooth-shaped electrode and the second comb tooth-shaped electrode are formed in the second conductive layer, and the first residual mask parts for the second comb tooth-shaped
15 electrode are removed by etching, in the sixth etching step;

second residual mask parts for the second comb tooth-shaped electrode are formed in the first conductive layer in the first etching step; and

20 the residual mask parts for the first comb tooth-shaped electrode and second residual mask parts for the second comb tooth-shaped electrode are removed by etching in the third etching step.

25 19. The method according to claim 1, further comprising a step for forming a first conductive connecting part that passes through the first insulating layer and electrically connect the first conductive layer and the second

conductive layer, and/or a step for forming a second
conductive connecting part that passes through the second
insulating layer and electrically connect the third
conductive layer and the second conductive layer.

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20. The method according to claim 7, further comprising a
step for forming a first conductive connecting part that
passes through the first insulating layer and electrically
connect the first conductive layer and the second
10 conductive layer, and/or a step for forming a second
conductive connecting part that passes through the second
insulating layer and electrically connect the third
conductive layer and the second conductive layer.

15 21. The method according to claim 4, further comprising a
step for forming a first conductive connecting part that
passes through the first insulating layer and electrically
connect respective conductive parts in each comb tooth-
shaped electrode, and/or a step for forming a second
20 conductive connecting part that passes through the second
insulating layer and electrically connect respective
conductive parts in each comb tooth-shaped electrode.

22. The method according to claim 10, further comprising a
25 step for forming a first conductive connecting part that
passes through the first insulating layer and electrically
connect respective conductive parts in each comb tooth-
shaped electrode, and/or a step for forming a second

conductive connecting part that passes through the second insulating layer and electrically connect respective conductive parts in each comb tooth-shaped electrode.